COLORADO RIVER RECOVERY PROGRAM Project No.:_147_
FY 2010-2011 SCOPE OF WORK

Standardization of Recovery Program Electrofishing Fleet

Lead Agency: Colorado Division of Wildlife

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Category:
____Ongoing
__X_Ongoing-revised project
____Requested new project
____Unsolicited proposal

Expected Funding Source:
____Annual funds
____Capital funds
__X_Other (Section 7)

I. Title of Proposal: *Standardization of Recovery Program Electrofishing Fleet*

II. Relationship to RIPRAP:

- General Recovery Program Support Action Plan
  - V.A. Measure and document population parameters to determine status and biological response to recovery actions.
  - V.A. 2. Evaluate population estimates.
  - V.C. Develop and enhance scientific techniques required to complete recovery actions.
  - V.D. Establish sampling procedures to minimize adverse impacts to endangered fishes.
  - V.D.2. Implement scientific sampling protocols to minimize mortality for all endangered fish.

III. Study Background/Rationale and Hypotheses:

The Colorado River Recovery Program (Recovery Program) consists of essentially six separate field stations conducting electrofishing in riverine critical habitat for endangered fishes and in adjacent river reaches. These stations include: U.S. Fish and Wildlife, Colorado River Fishery Project offices in Grand Junction, CO, and in Vernal, UT; Utah Division of Wildlife Resources offices in Moab and Vernal, UT; Colorado Division of Wildlife in Grand Junction, and the Larval Fish Lab at Colorado State University in Fort Collins. Similar sampling activity is also performed by San Juan

River Recovery Program personnel. Each field station has two or more rafts configured to conduct electrofishing in rivers to perform annual sampling native fishes or removal nonnative fishes.

Kolz (1989) developed a model of the transfer of power from water to fish which compensated for the power needed to deliver constant electric power to fish in waters with differing conductivities. This model is being used as a basis to standardize electrofishing in fishery research and management programs (Burkhardt and Gutreuter 1995, Chick et al. 1999, Miranda 2005). Bonar and Hubert (2002) elaborated the benefits of standardization for fisheries programs, including minimizing variation in catchability and maximizing catch. Standardizing the electrofishing fleet within the Recovery Program would promote and facilitate comparison of catch data among rivers and reaches, and may maximize the catch of target native or nonnative fishes, thus benefiting stock assessments or removal of target fishes (Martinez and Kolz 2009).

Standardization of electrofishing in waters having differing conductivities is essential when monitoring temporal and spatial differences in fish assemblages (Miranda and Dolan 2003). This scenario is characteristic of work performed by the Recovery Program in the Upper Colorado River Basin (UCRB) where periodic estimates of fish density and abundance are derived by electrofishing in several rivers known to have different water conductivities. Standardization of the amount of electrical power transferred to fish can reduce the variability of survey data and potentially reduce injury to fish (Miranda 2005). Burkhardt and Gutreuter (1995) improved the predictability of their electrofishing catch rates by adopting an electrofishing standardization protocol. Snyder (1995) cautioned that electrofishing-induced injury and mortality in sampled fishes can often be linked to excessive power levels.

Standardization of electrofishing equipment requires adjusting power output to keep constant the amount of power transferred to fish in diverse water conditions; however, this relationship can be affected by differences in electrode arrays (Miranda 2005). Further, the Recovery Program electrofishing fleet has switched primarily to Smith-Root GPP 5.0 electrofishers and some confusion may exist about the use of the percent of range control (Miranda and Spencer 2005). While complete standardization of an electrofishing fleet may not be entirely feasible, standardization of variables that can be accommodated by a fleet remains advisable (Miranda 2005).

Recent observations comparing the field performance of Smith-Root GPP 5.0 and VVP-15B electrofishers in the Yampa River suggested that the VVP-15B may have provided better catch rates of smallmouth bass (C. Walford, Colorado State University – Larval Fish Laboratory, unpublished data). The Yampa River typically has lower water conductivity than other rivers in the UCRB which appeared to contribute to this apparent difference in performance between the two models of electrofishers. To promote standardization of the electrical waveform used to capture fish in the UCRB, additional measurements would be required to identify and compare the differences in the electrical output characteristics of commercially available electrofishers used in boats or rafts.

The Recovery Program electrofishing fleet consists of both aluminum hull and inflatable boats (rafts) fitted with boom electrofishers. Aluminum boat hulls can be used as the cathode for electrofishing systems (USFWS 2004), and this is the recommended method for DC and pulsed-DC systems as more of the available power becomes allocated to the anodes (FWS/NCTC 2005). Aluminum boats used for electrofishing tend to be of similar dimensions (16-18 feet long) and they tend to be of similar electrical resistance, thus facilitating standardization, provided hull corrosion/anodization is minimal. Rafts rely on metal plates or trailing droppers as cathodes, which may be of different size, configuration, and electrical resistance.

The material, configuration and dimensions of the aluminum electrofishing boats facilitated development of a “standard boat” electrical system resistance in conjunction with paired, half-submerged spherical anodes. Because an electofisher mounted on an inflatable or other non-conductive hull boat requires a plate or trailing cathode, its fabrication may result in differences in the size, shape and amount of metal in the water that may cause electrical resistance of the electrode array to vary considerably. Further, since inflatable-mounted electrofishers are typically reserved for low- or extreme-flow conditions, they may be used with only one spherical anode due to the power constraints of smaller outboards or rowing which may limit maneuverability. This reduced maneuverability may also require the electrofisher to be fitted with a smaller generator that may limit power output. This lesser similarity among inflatable-mounted electrofishers in the Recovery Program’s electrofishing fleet makes it advisable and desirable to establish “standard raft” criteria similar to that performed for the fleet’s aluminum-hulled electrofishing boats (Martinez and Kolz 2009).

IV. Study Goals, Objectives, End Product:

Goal

The goal of this Scope-of-Work is to provide members of the Recovery Program’s electrofishing fleet with guidelines for standardizing their rafts and electrode arrays to facilitate standardization of the power output for their electrofishing. Upon standardization of the electrofishing rafts, a model specific to the conductivity range encountered by the Recovery Program electrofishing fleet in the upper Colorado River Basin (100-1000 µmhos) will facilitate setting electrofisher controls to achieve recommended power output to maximize fish capture while minimizing the likelihood of fish injury or mortality. Additional benefits of this process should be to reduce catch variability among rafts and rivers, to improve comparability of data across rivers, reaches and species, and to maximize the catchability of target fishes.

Objectives

1. Establish “standard” electrofishing raft to which other rafts in the fleet will be compared to evaluate the equivalent resistance of their electrode arrays.

2. Recommend electrode deployment, including anode (sphere) and cathode (boat hull) configuration, size and spacing to facilitate standardized electrical field and power output that can be accommodated by all rafts in the fleet.

3. Make measurements necessary to identify and compare the differences in the power output of commercially available electofishers used in boats or rafts.

4. Evaluate a representative subsample of raft-based boom-electrofishers in the fleet to identify the equivalent resistance of their electrodes and recommend maintenance, modification or repairs required for individual rafts to conform to the "standard raft".

5. Evaluate spherical anode size relative to power output capabilities of electrofishers and develop model to recommend conductivity thresholds for changing anode size to optimize power output of electrofishers.

6. Explain and encourage us of FLUKE 87-V clamp-current meters to measure threshold response of fish and their condition to the control settings of the electrofisher used at known levels differing water conductivity.

<u>End Products</u>

1. Standardized guidelines for deployment of electrodes including spacing, style, size, submersion and maintenance for use on electrofishing rafts.

2. An evaluation of the equivalent resistance of a sample of the fleet's individual rafts operating with boom electrofishers and recommendations needed for individual rafts to conform to the "standard".

3. A model specific to the conductivity range encountered by the fleet's rafts in upper Colorado River basin recommending conductivity thresholds at which adjustments of electrofishers control settings or a switch to different diameter spherical anodes would be made to optimize power output.

4. Recommend alternate electrofishers or other equipment to optimize the raft electrofishing fleet's standard operations, including capture effectiveness and avoidance of fish injury.

V. Study Area:

Work to establish "standard" raft for evaluation of equivalent resistance of electrodes, comparison of spherical anode sizes to power capabilities of electrofishers, and examination of electrofisher properties under variable load will be performed in Grand Junction. Evaluation of examples of the fleet's individual rafts will be performed either in Grand Junction or at the respective field stations.

VI. Study Methods/Approach:

Larry Kolz, retired engineer – USFWS, will make electrical measurements and calculations (Kolz 1993) using an inflatable raft configured by Bob Burdick, aquatic biologist-USFWS, to establish the "standard" raft. The evaluation of individual rafts will be performed in water of known conductivity. A model specific to the conductivity range encountered by the fleet's rafts in Upper Colorado River Basin recommending conductivity thresholds at which adjustments to electrofisher control settings or a switch to different sizes spherical anodes would be made to optimize power output. Static electrical loads simulating the range of water conductivities encountered by the electrofishing fleet in the UCRB will be used to measure and compare the power output and waveform characteristics of commercially available electrofishers used in boats and rafts.

VII. Task Description and Schedule

Description

1. Establish "standard" electrofishing raft.

2. Recommend electrode deployment that can be accommodated by all rafts in the fleet.

3. Evaluate examples of raft configurations in fleet and measure the equivalent resistance of their electrodes for comparison and make recommendations for individual rafts to conform to the "standard" raft.

4. Develop model specific to conductivity range encountered by electrofishing rafts in rivers of the Upper Basin to guide selection of spherical anode diameter and electrofisher control settings.

5. Identify suitability of alternate electrofishers or control settings for use with electrofishing boats and rafts in association with changing water conductivity.

VIII. **FY-2011 Work**

<u>Deliverables/Due Dates</u>:

1. Measurement and comparison of the power output and waveform characteristics of commercially available electrofishers used in boats and rafts (August 2010).

2. Specifications for fleet's "Standard Raft" (June 2011).

3. Model for Upper Basin water conductivity range recommending anode diameter and electrofisher control settings (September 2011).

4. Begin evaluation of conformity of individual boats in electrofishing fleet to "Standard Boat" (June 2011).

5. Manuscript preparation and revision.

<u>Budget</u>:

2010: Labor 160 hours @ $25/hour = $4,000.00

TOTAL FY 2011 = $4,000.00

2011: Labor: 300 hours @ $25/hour = $7,500.00
Assistant 200 hours@$16/hour=$3,200.00
Travel: $1,000.00

TOTAL FY 2011 = $11,700.00

IX. Budget summary
2010: $4,000.00
2011: $11,700.00

Total: $15,700.00

X. Reviewers:

Larry Kolz (retired USFWS), National Conservation Training Center
Angela Kantola, Colorado River Recovery Program, Lakewood

XI. References
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